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09/910,904	07/24/2001	Kan Yasui	ASAM.0012	3566

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Stanley P. Fisher
Reed Smith Hazel & Thomas LLP
3110 Fairview Park Drive, Suite 1400
Falls Church, VA 22042-4503

EXAMINER	
UMEZ ERONINI, LYNETTE T	
ART UNIT	**PAPER NUMBER**
1765	10

DATE MAILED: 10/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

ASD

Office Action Summary	Application No. 09/910,904	Applicant(s) YASUI ET AL.	
	Examiner Lynette T. Umez-Eronini	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 August 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 July 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1, 5, 6, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasaki et al. (US 5,607,718) in view of Moriyama et al. (US 6,180,020 B1).

Sasaki teaches, "The present invention relates to a polishing method as one semiconductor fabrication technique . . . (column 1, lines 11-15). "The present invention also provides a polishing agent storage vessel for storing a polishing agent, . . . a polishing agent supply pipe for supplying the polishing agent from the polishing

agent storage vessel onto the turntable . . . (column 3, lines 20-27). Sasaki also teaches, "On this SiO_2 film **42**, a . . . Al film **44** . . . were formed in this order" (column 15, lines 48-5). "CMP was performed for this sample . . . Note that a material prepared by dispersing 1.0 wt % of amorphous carbon particles (same as grindstone) with a mean particle size of 0.4 μm in pure water was used as a polishing agent. In this preparation of the polishing agent, ammonium polycarboxylate (same as applicant's dispersant and surfactant, as described in the Specification, page 9, line 28 –page 10, line 23) and was used as the dispersant" (column 15, lines 60-64). The aforementioned reads on,

A process for producing a semiconductor device, comprising the steps of:

using a grindstone formed of abrasive grains;

feeding a dispersant-containing processing liquid to a surface of the grindstone; and

polishing and planarizing the surface of a semiconductor wafer so as to expose at least two different thin films formed on the surface of the semiconductor wafer during a part or whole of processing time, **in claim 1**;

Since Sasaki uses ammonium carboxylate as a dispersant in a polishing agent as in the claimed invention, then using Sasaki's ammonium carboxylate dispersant in the same manner as the claimed invention further reads on,

wherein a surfactant is employed as the dispersant added to the processing liquid, **in claim 5**;

wherein a polycarboxylate is employed as the dispersant added to the processing liquid, **as in claim 6**;

wherein ammonium polyacrylate is used as the polycarboxylate, **as in claim 7**; and would inherently result wherein said dispersant enables to improve a polishing selectivity between said two different thin films, **in claim** 1; and in ammonium polyacrylate has a molecular weight ranging from 100 to 200000, **as in claim 9**.

Sasaki differs in failing to teach a resin binder for binding and retaining the abrasive grains, **in claim 1**.

Moriyama teaches, " . . . a polishing method using a grindstone comprising abrasive grains and a bonding resin for bonding the abrasive grains, as well as to a polishing apparatus to be used for the polishing method. By using a resin for bonding abrasive grains, it is possible to obtain a grindstone having a desired modulus of elasticity. With such a grindstone, the surface of a substrate having concave and convex portions can be rendered uniformly flat, irrespective of the size of the concave and convex portions" (Abstract), which reads on using a grindstone formed of abrasive grains and a resin binder for binding and retaining the abrasive grains.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki by using a resin binder as taught by Moriyama for the purpose of polishing a substrate having concave and convex portions (Abstract).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 2 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasaki ('718) in view of Moriyama (US '020 B1) as applied to claim 1 above, and further in view of Hosali et al (US 6,132, 637).

Sasaki in view of Moriyama differs in failing the teach wherein said at least two different thin films include a film mainly containing silicon dioxide and a film mainly containing silicon nitride, **in claim 2** and failing to specify the abrasive grains of the grindstone, as recited **in claim 10**.

Hosali teaches, "A composition is provided for polishing a composite comprised of silica and silicon nitride comprising: an aqueous medium, abrasive particles, a surfactant, and . . . a complexing agent (Abstract) and ". . . ceria was used for the abrasive particles in the slurry . . . Any other polishing abrasive, such as alumina, zirconia, and barium carbonate could also be used (column 2, lines 62-67).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki in view of Moriyama by using Hosali's method of polishing at least two different thin films of silicon dioxide and silicon nitride and using other abrasive particles as taught by Hosali

for the purpose of selectively polishing silicon dioxide relative to silicon nitride (column 2, lines 7-12).

6. Claims 2, 3, 4, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasaki ('718) in view of Moriyama ('020 B1) as applied to claim 1 above, and further in view of Kimura (US 5,869,392).

Sasaki in view of Moriyama differs in failing to teach wherein a concentration of the dispersant in the processing liquid is changed during processing, in claim 3; wherein at least 99% of the abrasive grains has a particle size of 0.001 μm or greater but not greater than 1 μm, in claim 4; and wherein the concentration of ammonium polyacrylate ranges from 0.05 wt. % to 5 wt. %, in claim 8.

Kimura teaches, " . . . In the CMP process, chemical polishing variables include the kind, pH, and composition of solvent; and mechanical polishing variables include the kind and concentration of slurry . . . (column 4, lines 11-16), which provides evidence that the concentration of a polishing slurry is a so-called "result effective variable."

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki in view of Moriyama by using Kimura as evidence that the concentration of slurry is a so-called "result effective variable" since it has been held that discovering an optimum value of a result effective variable involvers only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

7. Claims 11-13; 14-15; and 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasaki ('718) in view Moriyama ('020 B1) and of Hosali ('637) and further in view of Kimura ('392).

Sasaki teaches, "The present invention relates to a polishing method as one semiconductor fabrication technique . . . (column 1, lines 11-15). "The present invention also provides a polishing agent storage vessel for storing a polishing agent, . . . a polishing agent supply pipe for supplying the polishing agent from the polishing agent storage vessel onto the turntable. . . (column 3, lines 20-27). Sasaki also teaches "On this SiO_2 film **42**, a . . . Al film **44** . . . were formed in this order" (column 15, lines 48-5). "CMP was performed for this sample. . . . Note that a material prepared by dispersing 1.0 wt % of amorphous carbon particles (same as grindstone) with a mean particle size of 0.4 μm in pure water was used as a polishing agent. In this preparation of the polishing agent, ammonium polycarboxylate was used as the dispersant" (column 15, lines 60-64). The aforementioned reads on,

A process for producing a semiconductor device, comprising the steps of:

using a grindstone formed of abrasive grains;

feeding a dispersant-containing processing liquid to a surface of the grindstone; and

polishing and planarizing the surface of a semiconductor wafer so as to expose at least two different thin films formed on the surface of the semiconductor wafer during a part or whole of processing time, and polycarboxylate is used as the dispersant.

Sasaki differs in failing to teach a resin binder for binding and retaining the abrasive grains, **in claim 11**.

Moriyama teaches, " . . . a polishing method using a grindstone comprising abrasive grains and a bonding resin for bonding the abrasive grains, as well as to a polishing apparatus to be used for the polishing method. By using a resin for bonding abrasive grains, it is possible to obtain a grindstone having a desired modulus of elasticity. With such a grindstone, the surface of a substrate having concave and convex portions can be rendered uniformly flat, irrespective of the size of the concave and convex portions" (Abstract), which reads on using a grindstone formed of abrasive grains and a resin binder for binding and retaining the abrasive grains.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki by using a resin binder as taught by Moriyama for the purpose of polishing a substrate having concave and convex portions (Abstract).

Sasaki in view of Moriyama differs in failing the teach planarizing the surface of a semiconductor wafer over which a silicon nitride film and a silicon oxide film have been stacked one after another, **in claims 11, 14, and 16**.

Hosali teaches, "A composition is provided for polishing a composite comprised of silica and silicon nitride comprising: an aqueous medium, abrasive particles, a surfactant, and . . . a complexing agent (Abstract), which reads on, planarizing the surface of a semiconductor wafer over which a silicon nitride film and a silicon oxide film have been stacked one after another.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify the method of Sasaki in view of Moriyama by using Hosali's semiconductor surface, which has at least two different thin films of silicon dioxide and silicon nitride and using other abrasive particles as taught by Hosali for the purpose of selectively polishing silicon dioxide relative to silicon nitride (Hosali, column 2, lines 7-12).

Sasaki in view of Moriyama and Hosali differs in failing to teach:

wherein the dispersant has a concentration permitting a removal rate ratio of the silicon oxide film not less than 20 relative to the silicon nitride film, in claim 11; and wherein the concentration of dispersant ranges from 1 wt % to 4 wt %, in claim 12;

wherein the dispersant is fed at a low concentration an initial stage of polishing, followed for high removal rate of said silicon oxide, followed by an increase in the concentration for high selectivity of removal rate of said silicon oxide to said silicon nitride, in claim 14;

wherein the concentration of the dispersant is 1% or less at the initial stage and then it is increased to 1.5 % or greater, in claim 15;

wherein the processing liquid is supplied while setting the concentration of the dispersant within a range permitting a removal rate of the silicon nitride film once decreased to a low level and maintained at substantially the same low level and a removal rate of the silicon oxide film once increased to a high level and maintained at substantially the same high level, in claim 16; and

wherein the processing liquid is supplied while setting the concentration of the dispersant within a range permitting a removal rate of the silicon nitride film once decreased to a low level and maintained at substantially the same low level and a removal rate of the silicon oxide film decreased from the maximum value, in claim 17.

Kimura teaches, " . . . In the CMP process, chemical polishing variables include the kind, pH, and composition of solvent; and mechanical polishing variables include the kind and concentration of slurry . . . (column 4, lines 11-16), which provides evidence that the concentration of a polishing slurry is a so-called "result effective variable" and would result in the dispersant having a concentration permitting a removal rate ratio of the silicon oxide film not less than 20 relative to the silicon nitride film, in claim 11 and would result wherein the concentration of the dispersant in the processing liquid is changed during the processing as in claims 12, 14, 15, 16, and 17.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki in view of Moriyama and Hosali by using Kimura as evidence that the concentration of slurry is a so-called "result effective variable" since it has been held that discovering an optimum value of a result effective variable involvers only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

8. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sasaki ('718) in view of Moriyama (US 020 B1) and further in view of Hosali (637).

Sasaki teaches, "The present invention relates to a polishing method as one semiconductor fabrication technique . . . (column 1, lines 11-15). "The present invention also provides a polishing agent storage vessel for storing a polishing agent, . . . a polishing agent supply pipe for supplying the polishing agent from the polishing agent storage vessel onto the turntable. . . (column 3, lines 20-27). Sasaki also teaches "On this SiO_2 film **42**, a . . . Al film **44** . . . were formed in this order" (column 15, lines 48-5). "CMP was performed for this sample. . . . Note that a material prepared by dispersing 1.0 wt % of amorphous carbon particles (same as grindstone) with a mean particle size of 0.4 μm in pure water was used as a polishing agent. In this preparation of the polishing agent, ammonium polycarboxylate was used as the dispersant" (column 15, lines 60-64). The aforementioned reads on,

A production process for producing a semiconductor device, comprising at least the following steps of:

using a grindstone formed of abrasive grains;

feeding a dispersant-containing processing liquid to the surface of the polishing the surface of the grindstone;

polishing the surface of a semiconductor substrate, thereby planarizing said insulating film. Since Sasaki uses ammonium carboxylate as a dispersant in a polishing agent as in the claimed invention, then using Sasaki's ammonium carboxylate dispersant in the same manner as the claimed invention would inherently result,

wherein said dispersant enables to improve a polishing selectivity between said insulating film and silicon nitride film.

Sasaki differs in failing to teach a resin binder for binding and retaining the abrasive grains, **in claim 19**.

Moriyama teaches, " . . . a polishing method using a grindstone comprising abrasive grains and a bonding resin for bonding the abrasive grains, as well as to a polishing apparatus to be used for the polishing method. By using a resin for bonding abrasive grains, it is possible to obtain a grindstone having a desired modulus of elasticity. With such a grindstone, the surface of a substrate having concave and convex portions can be rendered uniformly flat, irrespective of the size of the concave and convex portions" (Abstract), which reads on using a grindstone formed of abrasive grains and a resin binder for binding and retaining the abrasive grains.

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki by using a resin binder as taught by Moriyama for the purpose of polishing a substrate having concave and convex portions (Abstract).

Sasaki in view of Moriyama differs differ in failing to teach forming a silicon nitride film over a semiconductor substrate and then forming a trench for isolation region in the semiconductor substrate; forming an insulating film over said trench for isolation region and said silicon nitride film; and leaving the insulating film only in said trench for isolation region; and removing the silicon nitride film from the substrate in a region

other than the isolation region, wherein said dispersant enables to improve a polishing selectivity between said insulating film and silicon nitride.

Hosali teaches, "A composition is provided for polishing a composite comprised of silica and silicon nitride comprising: an aqueous medium, abrasive particles, a surfactant, and . . . a complexing agent (Abstract).

It is the examiner's position that it would have been obvious to one having ordinary skill in the art at the time of the claimed invention to modify Sasaki' in view of Hosali by using a conventional method of forming a trench isolation region in a semiconductor substrate by forming a silicon nitride and an insulating film over the semiconductor substrate for the purpose of selectively polishing silicon dioxide relative to silicon nitride (Hosali, column 2, lines 7-12).

9. Claims 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasaki ('718) in view of Moriyama ('020 B1) and Hosali ('637) as applied to claim 19 and further in view of Kimura ('392).

Sasaki in view of Moriyama and Hosali differs in failing to teach:

wherein the dispersant has a concentration permitting a removal rate ratio of the silicon oxide film not less than 20 relative to the silicon nitride film, in claim 20;

having a dispersant concentration set low at an initial stage of polishing and then supplying the processing liquid having an increased concentration, in claim 21;

having a dispersant within a range permitting a removal rate of the silicon nitride film once decreased to a low level and maintained at substantially the same low level

and a removal rate of the silicon oxide film once increased to a high level and maintained at substantially the same high level, in claim 22.

Kimura teaches, " . . . In the CMP process, chemical polishing variables include the kind, pH, and composition of solvent; and mechanical polishing variables include the kind and concentration of slurry . . . (column 4, lines 11-16), which provides evidence that the concentration of a polishing slurry is a so-called "result effective variable" and would result in the dispersant having a concentration permitting a removal rate ratio of the silicon oxide film not less than 20 relative to the silicon nitride film, in claim 20 and would result wherein the concentration of the dispersant in the processing liquid is changed during the processing as in claims 21-22.

Response to Arguments

10. Applicant's arguments with respect to claims 1-22 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynette T. Umez-Eronini whose telephone number is 703-306-9074. The examiner is normally unavailable reached on the First Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 703-305-2667. The fax phone numbers for the organization where this application or proceeding is assigned 703-872-9306 for regular communications and for After Final communications.

ltue
October 14, 2003

NADINE G. NORTON
PRIMARY EXAMINER